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(72) Inventor: **Kawan, Joseph C.**

**Hollywood, CA-90068 (US)**

(74) Representative:

**Beetz & Partner**

**Patentanwälte**

**Steinsdorfstrasse 10**

**80538 München (DE)**

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(71) Applicant:

**Citicorp Development Center, Inc.**

**Los Angeles, California 90066 (US)**

**(54) Method and system of contactless interfacing for smart card banking**

(57) A method and system of smart card banking utilizes a contactless communication interface, such as infrared or a wireless or radio frequency interface, including, for example, a proximity interface. A contactless communication is initiated for a smart card user between a smart card application and the on-line system of a financial institution, such as a bank, the system verifies authorization for the communication, the information is communicated for the user to the on-line system. The contactless communication is initiated, and the information is communicated, for example, between a contactless interface transceiver of a personal data assistant, into which the smart card is inserted, and the contactless interface transceiver of an on-line terminal. Alternatively, the contactless communication is initiated, and the information is communicated between a contactless interface transceiver of the smart card and the contactless interface transceiver of the terminal.

## Description

### Cross-Reference to Related Applications

[0001] This application claims the benefit of U.S. Provisional Application No. 60/073,091 filed January 30, 1998.

### Field of the Invention

[0002] The present invention relates generally to the field of smart cards, and more particularly to a method and system of smart card banking using a contactless interface between the smart card and a financial institution banking system.

### Background

[0003] The use of smart card technology in the consumer environment places a high physical demand on the devices. In order to be considered practical, they must be able to withstand significant wear and tear. The current use of devices with, for example, metallic contacts for the interface, involves significant physical limitations, such as cables and connections, and such devices are especially susceptible to physical wear and tear. Thus, there is a need for a method and system of smart card banking, which utilizes a contactless interface to establish a communications link between the smart card and the banking institution, and which minimizes wear and tear on the interfacing devices and maximizes durability of such devices.

### Summary of the Invention

[0004] It is a feature and advantage of the present invention to provide a method and system of smart card banking utilizing a contactless interface to establish a communications link for bi-directional flow of data between the smart card and a banking institution, which provides all the benefits of contact interface without the physical limitations of the contacts and without any significant increase in cost.

[0005] It is a further feature and advantage of the present invention to provide a method and system of smart card banking using a contactless communications interface to increase durability.

[0006] It is an additional feature and advantage of the present invention to provide a method and system of smart card banking utilizing a contactless interface to improve ease-of-use and to eliminate the need, for example, for cables and connections.

[0007] To achieve the stated and other features, advantages and objects of the present invention, an embodiment of the invention provides a method and system of smart card banking utilizing a contactless interface. According to an embodiment of the invention, a contactless communication is initiated for a smart card

user between a smart card application residing, for example, on a smart card microcomputer and the on-line system, for example, of a financial institution, such as a bank. The system verifies authorization for the communication, and once the authorization is verified, information can be communicated for the user to the on-line system. The contactless communication is initiated by initiating a contactless communication interface, such as an infrared communication interface or a wireless or radio frequency communication interface, including, for example, a proximity communication interface.

[0008] In an embodiment of the present invention, the contactless communication is initiated, for example, at a terminal, such as an automated teller machine, a personal computer, or a land or wireless telephone, through a contactless communication transceiver of the terminal, such as an infrared transceiver or a wireless or radio frequency transceiver, including, for example, a proximity transceiver. The contactless communication is initiated between the contactless communication transceiver of the terminal and a contactless communication transceiver of a personal data assistant, such as an electronic purse or wallet. Further, the process of initiating the contactless communication also involves, for example, initiating a physical contact communication between the smart card imbedded with a smart card microcomputer, on which the smart card application resides, and the personal data assistant, such as the electronic purse or wallet, which includes a card reader. In an alternate embodiment of the present invention, the smart card is provided with a contactless communication interface transceiver, such as an infrared transceiver or a wireless or radio frequency transceiver, including, for example, a proximity transceiver, and the contactless communication is initiated directly between the smart card contactless communication interface transceiver and the contactless communication interface transceiver of the terminal.

[0009] In an embodiment of the present invention, the authorization for the communication is verified, for example, by one or both of the personal data assistant, such as the electronic purse, and the on-line terminal, such as the automated teller machine, the personal computer, or the telephone. The authorization verification involves, for example, verifying the authenticity of the smart card and checking security information for the user, such as the user's PIN number or biometric information, such as the user's fingerprint. The security information is received by the system through an input/output device of the personal data assistant or the terminal. Once the authorization is verified, information can then be communicated for the user to the on-line system, likewise by inputting the information through the input/output device of the personal data assistant or the terminal.

[0010] Additional objects, advantages and novel features of the invention will be set forth in part in the description which follows, and in part become more

apparent to those skilled in the art upon examination of the following or may be learned by practice of the invention.

### Brief Description of the Drawings

[0011]

Fig. 1 depicts samples of key hardware components for an embodiment of the present invention;

Fig. 2 depicts and provides further detail regarding the personal data assistant hardware component for an embodiment of the present invention;

Figs. 3-4 illustrate key hardware components for an alternate embodiment of the present invention;

Figs. 5-6 illustrate key hardware components for another alternate embodiment of the present invention;

Fig 7 is a schematic flow chart which illustrates an example of the process of loading a smart card into a personal data assistant for an embodiment of the present invention;

Fig. 8 is a schematic flow chart which illustrates an example of the process of a contactless interface transaction between the smart card loaded in the personal data assistant with the smart card loaded and an automated teller machine for an embodiment of the present invention;

Fig. 9 is a schematic flow chart which illustrates an example of the process of a contactless interface transaction in which the personal data assistant communicates directly with the automated teller machine without the smart card for an embodiment of the present invention; and

Fig. 10 shows a smart card hardware component for an additional alternate embodiment of the present invention.

### Detailed Description of the Invention

[0012] Referring now in detail to an embodiment of the present invention, an example of which is illustrated in the accompanying drawings, Fig. 1 illustrates samples of hardware components for an embodiment of the present invention. The hardware components include, for example, a smart card 20 in the form of a credit card-sized plastic card with a microcomputer having memory to set up and securely store data. A personal data assistant (PDA) 22 provides a physical interface with smart card 20 in order to exchange information and perform transactions. Personal data assistant 22 is, for example, an electronic purse or wallet, or any other alphanumeric input/output and display device able to provide a conduit between smart card 20 and a financial institution, such as through an automated teller machine (ATM) 24. Automated teller machine 24 is, for example, a device capable of verifying and authorizing smart card 20 and performing financial institution and other similar

data exchange transactions.

[0013] Fig. 2 provides further detail regarding the personal data assistant hardware component for an embodiment of the present invention. Personal data assistant 22 includes, for example, a contactless communications interface 26 for input and output of data, such as an infrared (IR) emitter and sensor. The IR interface enables fast data transfer rates, such as 100 kilobits/second, while providing a large emitter target area that allows for some misalignment between the communicating devices, such as personal data assistant 22 and automated teller machine 24. While the example embodiment depicted in the drawings utilizes an IR interface, it will be appreciated that other contactless interfaces, such as wireless technologies or proximity-type technologies, can likewise be successfully utilized for an embodiment of the present invention. Additionally, the personal data assistant 22 may also be provided, for example, with ports 34 for direct communications links, such as by connecting wires or cables between devices. This redundant communications capability advantageously increases the utility of the personal data assistant 22, so that it can interact, for example, with more data transfer devices.

[0014] In an embodiment of the present invention, personal data assistant 22 also includes a smart card reader 28 communicating with smart card 20. Smart card 20 is inserted into smart card reader 28 of personal data assistant 22, which verifies the smart card. The verification process involves, for example, checking security information, such as a personal identification number (PIN) or biometric information of the user of the smart card 20. Personal data assistant 22 is also provided with a display 30 and an alphanumeric keypad 32, or other similar input/output means, for viewing, inputting, and manipulating this information and other data.

[0015] In an embodiment of the present invention, personal data assistant 22 performs transactions with the smart card 20 and has memory in which it is capable of storing various information and programs. Depending on the configuration of the personal data assistant 22, the memory capacity can be, for example, 16 megabytes or more. Further, the personal data assistant 22 is enabled, for example, by its own power source, such as a battery. Alternative power source configurations for the personal data assistant 22 include, for example, direct connections to external power supplies or contactless connections, such as with magnetic field-induced voltage.

[0016] In an embodiment of the present invention, personal data assistant 22 communicates with automated teller machine 24 through the contactless communications interface 26. Automated teller machine 24 includes, for example, a display 36, an alphanumeric keypad 38 or other similar input/output means, a printer with printer output 40, a card reader 42, and a money dispenser 44. The personal data assistant 22 is aligned with contactless communications interface 46 on auto-

mated teller machine 24, for example, by placing the personal data assistant on a ledge or shelf 48. Shelf 48, or other equivalent structure, is configured such that it guides the contactless communications interface 26 on personal data assistant 22 into substantial alignment with the contactless communications interface 46 on automated teller machine 24. While in the embodiment example depicted in the drawings, interface 46 utilizes IR interface contactless communications technology with an IR emitter and sensor, it will be appreciated that other contactless interfaces, such as wireless technologies or proximity-type technologies, can likewise be successfully used for an embodiment of the present invention.

**[0017]** Figs. 3-4 illustrate key hardware components for an alternate embodiment of the present invention. In an alternate embodiment of the invention, the hardware components include a personal data assistant 122 placed directly on display or IR touch screen 136 of automated teller machine 124. In this embodiment, personal data assistant 122 includes contactless communications interface 126 disposed on the end of the personal data assistant. It will be appreciated by those skilled in the art that other placements of interface 126, such as on a side of personal data assistant 122, are equally feasible. Further, the personal data assistant 122 includes a port 134 for direct communications links, such as by connecting wires or cables between devices.

**[0018]** In an embodiment of the present invention, IR touch screen 136 includes sets of IR emitters 125 on one side that correspond to sets of IR sensors 127 on the opposite side. This arrangement of emitters 125 and sensors 127 essentially divides display 136 into a grid, wherein a position on the grid may be determined by the intersection of perpendicular pairs of emitters and sensors, as illustrated by the dotted lines in Fig. 3. Thus, for a successful communication to occur, a proper alignment of personal data assistant 122 within the grid framework is required.

**[0019]** Referring to Fig. 3 for an embodiment of the present invention, display 136 further includes a custom touch screen having a set IR emitter/sensor pair 129 in substantial alignment for communication with communications interface 126 on the end of personal data assistant 122 with the proper positioning of the personal data assistant. There are numerous ways to insure proper positioning of personal data assistant 122, such as by providing markings on the surface of display 136, markings on the face of automated teller machine 124 adjacent display 136, and by providing built-in structure on the face of automated teller machine 124 to limit the positioning of personal data assistant 122. For example, if the touch screen is not oriented horizontally or at a low angle, then support 80 may be required to hold personal data assistant 122 in position on the touch screen. Other configurations will be obvious to those skilled in the art. In this manner, communications interface 126 on personal data assistant 22 interacts directly with

emitter/sensor pair 129 of display 136.

**[0020]** Figs. 5-6 illustrate key hardware components for another alternate embodiment of the present invention. For example, in such alternate embodiment of the present invention, personal data assistant 222 includes a single IR emitter 231 on one side and a single IR sensor 233 on an adjacent side. Further, personal data assistant 222 includes port 234 for direct communications links, such as by connecting wires or cables between devices. When personal data assistant 222 is placed on IR touch screen or display 236 of automated teller machine 224, single emitter 231 substantially aligns with a corresponding sensor 229 and, similarly, sensor 233 is in substantial alignment with corresponding emitter 229. Thus, personal data assistant 222 is able to communicate with automated teller machine 224.

**[0021]** Fig. 7 is a schematic flow chart with illustrates an example of the process of loading a smart card into a personal data assistant for an embodiment of the present invention. For example, at S1, a smart card 20 is inserted into a personal data assistant 22 or, for example, an electronic wallet or purse. At S2, personal data assistant 22, or the wallet or purse, performs a verification process. This process validates smart card 22 and involves security checks, which consist, for example, of the entering one or both of a secret PIN number and biometric information, such as finger prints for the user. Once smart card 20 is validated, then at S3, transactions between personal data assistant 22 and the smart card 20 may occur. Thus a user can control the transactions through input/output means, such as keypad 32, on the personal data assistant 22 and can view information on the display 30. The types of transactions that the user can perform include, for example, loading or unloading phone numbers and addresses, updating stocks, performing financial transactions and checking balances. Thus, information and data can be exchanged between the smart card 20 and the personal data assistant 22, and the information on the smart card can be viewed on the personal data assistant.

**[0022]** Fig. 8 is a schematic flow chart which illustrates an example of a contactless transaction between the smart card loaded in the personal data assistant and an automated teller machine for an embodiment of the present invention. Once smart card 20 is loaded in personal data assistant 22, the personal data assistant loaded with the smart card can then be used to perform transactions with an on-line system, such as a financial institution. At S11, the IR capability of the personal data assistant enables a contactless communication interface to be established between the personal data assistant 22 and the on-line system. As shown in Figs. 1, 3, and 6, this interface can include aligning the personal data assistant on the automated teller machine 24, 124, or 224 with a corresponding IR interface. Alternatively, the interface can consist of aligning the IR interface on the personal data assistant with a corre-

sponding IR interface on a phone, cell phone, computer or other similar devices capable of performing transactions.

[0023] In an embodiment of the present invention, the contactless interface advantageously allows the user to quickly establish contact, for example, with automated teller machine 24, 124, or 224 without worrying about connecting cables or aligning the devices precisely. When the personal data assistant establishes communications with the automated teller machine, for example, an authorization and verification process begins. At S12, the automated teller machine 24 or on-line system verifies the smart card 20 within the personal data assistant 22. The user may be required to input information, such as a PIN or biometric information. Upon completing the verification, the user can then perform transactions with the on-line system through the personal data assistant 22, at S13. For example, the user can have a pre-loaded program that skips the typical selection screens on the automated teller machine 24 and directly performs a specified transaction. At S14, such transactions may include, for example, loading value on the smart card 20, making investments, loading or unloading data such as addresses, phone numbers or stock information, and many other similar transactions.

[0024] In an embodiment of the present invention, it is to be recognized that an important feature of a smart card is the ability to authenticate the physical card. The smart card with account and/or security information is used in the opening of a transaction to identify the user's account and, through the authentication of encrypted security information, to verify that the particular card is authentic. In order to verify that it is the correct user that is submitting or using the smart card, the secret PIN number and/or biometric information is sent with the card during the start of a transaction. The secret PIN number and/or biometric information, such as the user's fingerprint, is always encrypted for external transmission. Alternatively, to provide a further level of security, the entered PIN number and/or biometric information can be used to unlock the smart card to enable the card to communicate its information. If the personal data assistant or other smart card-accepting device has the required security, both the secret PIN number and the biometric information, along with the card information, can be stored, for example, for a one-time use or for multiple uses, depending on the level of security required. This can occur, for example, on an automated teller machine or where a normal contact interface smart card would be slow to execute a transaction, such as a with a personal data assistant which has the contactless interface capability, for example, with a prepackaged transaction.

[0025] In an alternate embodiment of the present invention, the personal data assistant 22 may communicate directly, for example, with the automated teller machine 24 or financial institution without having the

smart card 20 loaded in the personal data assistant. Fig. 9 is a schematic flow chart with illustrates an example of the process of a contactless transaction in which the personal data assistant communicates directly with an automated teller machine without the smart card. For example, at S21, the personal data assistant 22 stores the secret verification information that is contained on the smart card 20. This process requires a very high level of security for the personal data assistant 22, as a higher level of security is generally required for a smart card as opposed to a personal data assistant. In this case, the user can, for example, perform transactions separately, between the smart card 20 and the personal data assistant 22 and between the personal data assistant and the automated teller machine 24. For example, at S22, the user enters the transaction to the personal data assistant. At S23, the user initiates the contactless interface between the personal data assistant and the on-line system of the financial institution by inserting the personal data assistant into the automated teller machine. At S25, information and data are interchanged for the user between the personal data assistant and the automated teller machine. At S26, the transactions then need to be reconciled on the smart card 20 or the automated teller machine 24.

[0026] Fig. 10 provides further detail regarding a smart card for an additional alternate embodiment of the present invention. In the additional alternate embodiment, the smart card 320 has, for example, an alphanumeric input/output keypad 332, a display 330, and an IR communications interface 326. Smart card 320 is also provided with sufficient memory to perform various financial transactions. Thus, in such an embodiment, the smart card 320 communicates directly with the financial institution through the IR interface 326, for example, through an automated teller machine, a phone, a cell phone, a computer, or other similar device with corresponding IR interface, and the user may view and manipulate the transactions.

[0027] Various preferred embodiments of the invention have been described in fulfillment of the various objects of the invention. It should be recognized that these embodiments are merely illustrative of the principles of the present invention. Numerous modifications and adaptations thereof will be readily apparent to those skilled in the art without departing from the spirit and scope of the present invention. Accordingly, the invention is only limited by the following claims.

## Claims

1. A method of contactless interfacing for a smart card, comprising:

initiating a contactless communication for a user between a smart card application and an on-line system;  
verifying authorization for the communication

for the user; and  
communicating information for the user to the  
on-line system.

2. The method of claim 1, wherein initiating the communication further comprises initiating an infrared communication interface. 5
3. The method of claim 1, wherein initiating the communication further comprises initiating a wireless communication interface. 10
4. The method of claim 3, wherein initiating the wireless communication interface further comprises initiating a radio frequency communication interface. 15
5. The method of claim 4, wherein initiating the radio frequency communication interface further comprises initiating a proximity communication interface. 20
6. The method of claim 1, wherein initiating the communication further comprises initiating the communication between the smart card application on a smart card microcomputer and the on-line system. 25
7. The method of claim 1, wherein initiating the communication further comprises initiating the communication between the smart card application and the on-line system of a financial institution. 30
8. The method of claim 7, wherein the financial institution further comprises a bank.
9. The method of claim 1, wherein initiating the communication further comprises initiating the communication at a terminal. 35
10. The method of claim 9, wherein initiating the communication at the terminal further comprises initiating the communication through a contactless communication transceiver of the terminal. 40
11. The method of claim 10, wherein initiating the communication further comprises initiating the communication through an infrared transceiver of the terminal. 45
12. The method of claim 11, wherein the terminal comprises an automated teller machine. 50
13. The method of claim 11, wherein the terminal comprises a personal computer.
14. The method of claim 11, wherein the terminal comprises a telephone. 55
15. The method of claim 11, wherein the terminal comprises a wireless telephone.

16. The method of claim 10, wherein initiating the communication further comprises initiating the communication through a wireless transceiver of the terminal.
17. The method of claim 16, wherein the wireless transceiver further comprises a radio frequency transceiver of the terminal.
18. The method of claim 17, wherein the terminal comprises an automated teller machine.
19. The method of claim 17, wherein the terminal comprises a personal computer.
20. The method of claim 17, wherein the terminal comprises a telephone
21. The method of claim 20, wherein the telephone further comprises a wireless telephone.
22. The method of claim 10, wherein initiating the communication further comprises initiating the communication through a proximity transceiver of the terminal.
23. The method of claim 22, wherein the terminal comprises an automated teller machine.
24. The method of claim 22, wherein the terminal comprises a personal computer.
25. The method of claim 22, wherein the terminal comprises a telephone.
26. The method of claim 25, wherein the telephone further comprises a wireless telephone.
27. The method of claim 10, wherein initiating the communication further comprises initiating the communication between the contactless communication transceiver of the terminal and a contactless communication transceiver of a personal data assistant.
28. The method of claim 27, wherein the terminal comprises an automated teller machine.
29. The method of claim 27, wherein the terminal comprises a personal computer.
30. The method of claim 27, wherein the terminal comprises a telephone.
31. The method of claim 30, wherein the telephone further comprises a wireless telephone.

32. The method of claim 27, wherein initiating the communication further comprises initiating a physical contact communication between the smart card and the personal data assistant.
33. The method of claim 27, wherein the personal data assistant further comprises an electronic purse or wallet.
34. The method of claim 10, wherein initiating the communication further comprises initiating the communication between the contactless communication transceiver of the terminal and a contactless communication transceiver of the smart card.
35. The method of claim 34, wherein the terminal comprises an automated teller machine.
36. The method of claim 34, wherein the terminal comprises a personal computer.
37. The method of claim 34, wherein the terminal comprises a telephone.
38. The method claim 37, wherein the telephone further comprises a wireless telephone.
39. The method of claim 1, wherein verifying the authorization further comprises verifying the authorization by a personal data assistant.
40. The method of claim 1, wherein verifying the authorization further comprises verifying the authorization by a terminal.
41. The method of claim 40, wherein verifying the authorization further comprises verifying the authorization by a terminal of the on-line system.
42. The method of claim 1, wherein verifying the authorization further comprises verifying the authenticity of the smart card.
43. The method of claim 1, wherein verifying the authorization further comprises checking security information for the user.
44. The method of claim 43, wherein checking security information further comprises receiving security information for the user.
45. The method of claim 44, wherein receiving security information further comprises receiving a PIN number for the user.
46. The method of claim 44, wherein receiving security information further comprises receiving biometric information for the user.
47. The method of claim 44, wherein receiving security information further comprises receiving the security information on an input/output device.
48. The method of claim 47, wherein receiving the security information further comprises receiving the security information through the input/output device of a personal data assistant.
49. The method of claim 48, wherein the personal data assistant comprises an electronic purse or wallet.
50. The method of claim 47, wherein receiving the security information further comprises receiving the information through the input/output device of a terminal.
51. The method of claim 50, wherein the terminal comprises an automated teller machine.
52. The method of claim 50, wherein the terminal comprises a personal computer.
53. The method of claim 50, wherein the terminal comprises a telephone.
54. The method of claim 52, wherein the telephone further comprises a wireless telephone.
55. The method of claim 1, wherein communicating the information further comprises receiving the information through an input/output device.
56. The method of claim 55, wherein receiving the information further comprises receiving the information through the input/output device of a personal data assistant.
57. The method of claim 56, wherein the personal data assistant comprises an electronic purse or wallet.
58. The method of claim 55, wherein receiving the information further comprises receiving the information through the input/output device of a terminal.
59. The method of claim 58, wherein the terminal comprises an automated teller machine.
60. The method of claim 58, wherein the terminal comprises a personal computer.
61. The method of claim 58, wherein the terminal comprises a telephone.
62. The method of claim 61, wherein the telephone further comprises a wireless telephone.

63. A contactless interface system for a smart card, comprising:
- means for initiating a contactless communication between a smart card application and an on-line system; 5
- means associated with the initiating means for verifying authorization for the communication; and
- means associated with the verifying means for communicating information to the on-line system. 10
64. The system of claim 63, wherein the initiating means comprises an infrared interface communication device. 15
65. The system of claim 63, wherein the initiating means comprises a wireless interface communication device. 20
66. The system of claim 63, wherein the initiating means comprises a radio frequency interface communication device. 25
67. The system of claim 63, wherein the remote application comprises the smart card application on a smart card microprocessor.
68. The system of claim 63, wherein the initiating means comprises a terminal. 30
69. The system of claim 68, wherein the terminal comprises an automated teller machine. 35
70. The system of claim 68, wherein the terminal comprises a personal computer.
71. The system of claim 68, wherein the terminal comprises a telephone. 40
72. The system of claim 63, wherein the on-line system comprises a bank host on-line system.
73. The system of claim 63, wherein the communicating means comprises a personal data assistant. 45
74. The system of claim 73, wherein the personal data assistant comprises an electronic purse or wallet. 50
75. The system of claim 63, wherein the communicating means comprises a terminal.
76. The system of claim 75, wherein the terminal comprises an automated teller machine. 55
77. The system of claim 75, wherein the terminal comprises a personal computer.
78. The system of claim 75, wherein the terminal comprises a telephone.



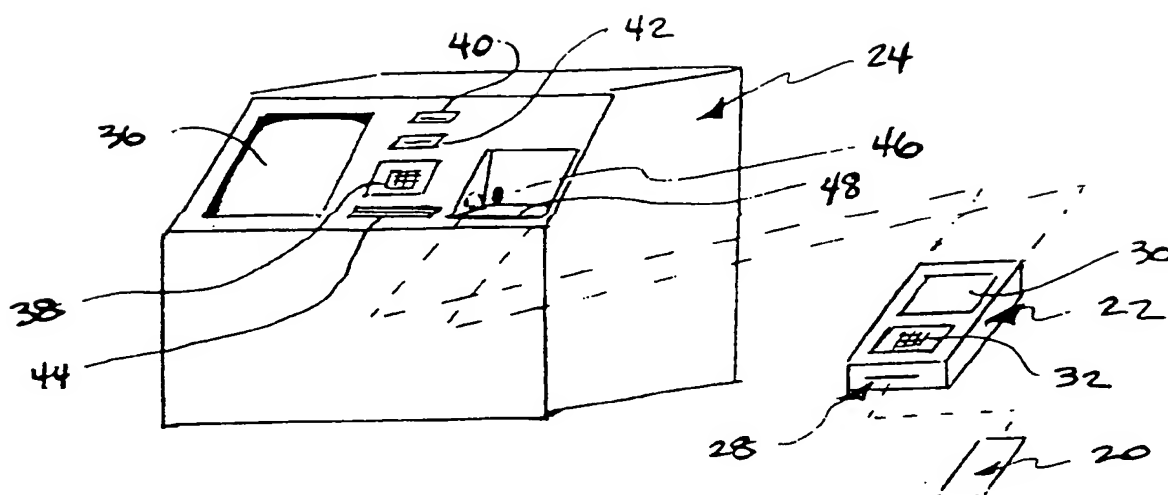


FIG. 1

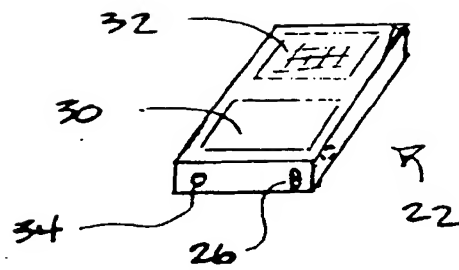


FIG. 2

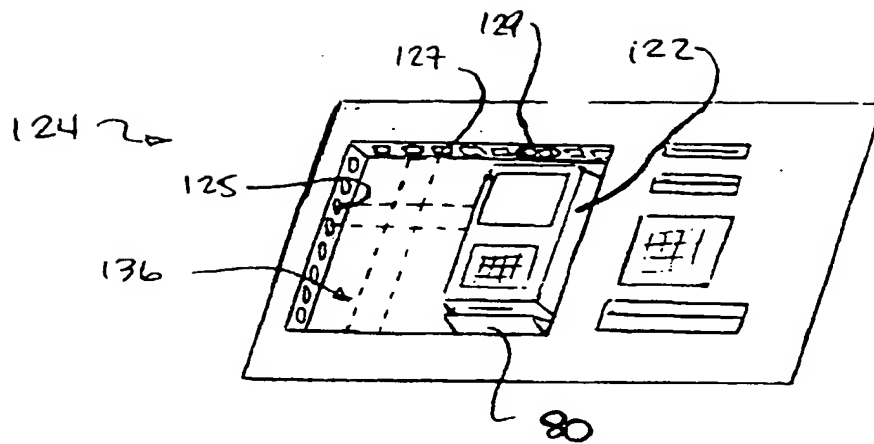


FIG. 3

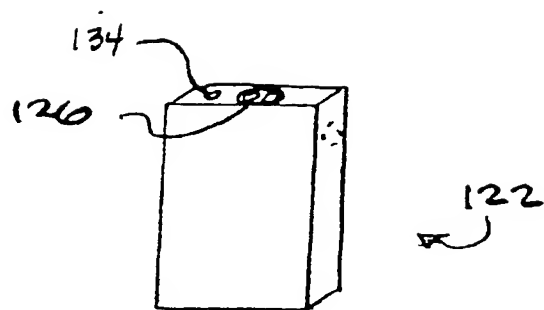
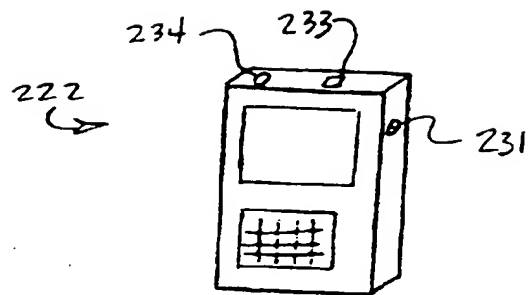


FIG. 4



**FIG. 5**

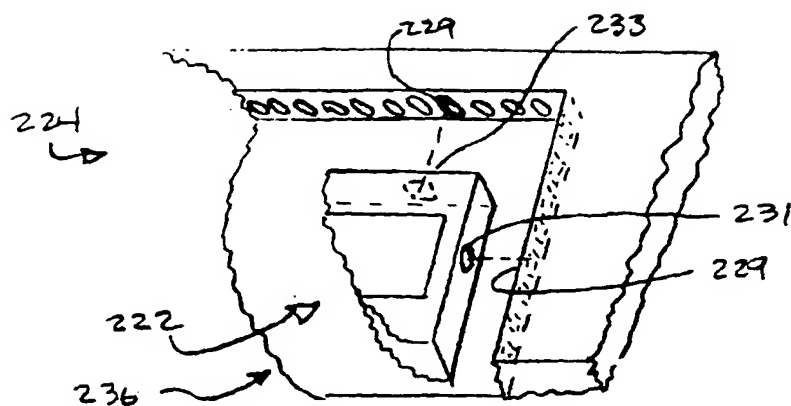
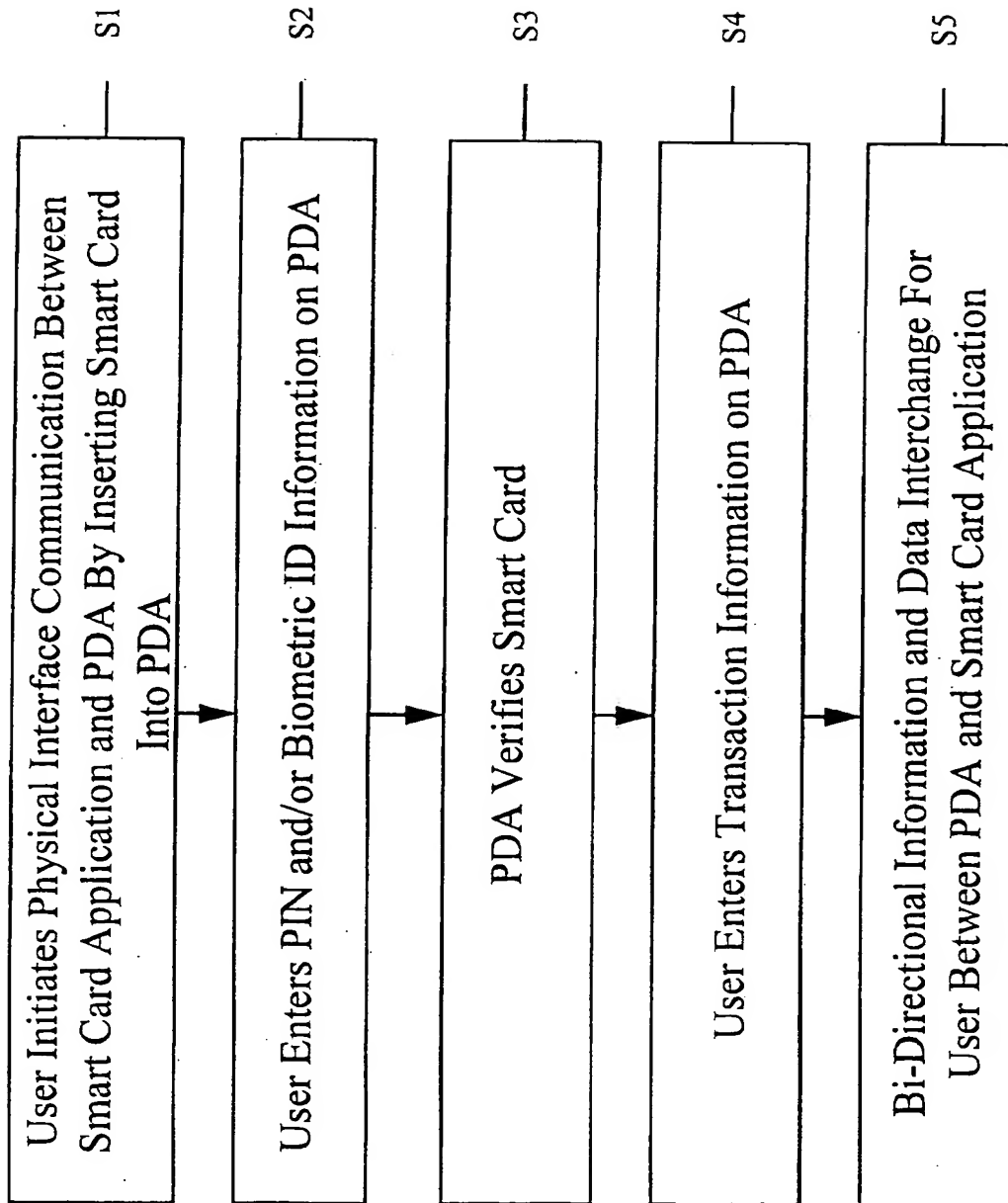
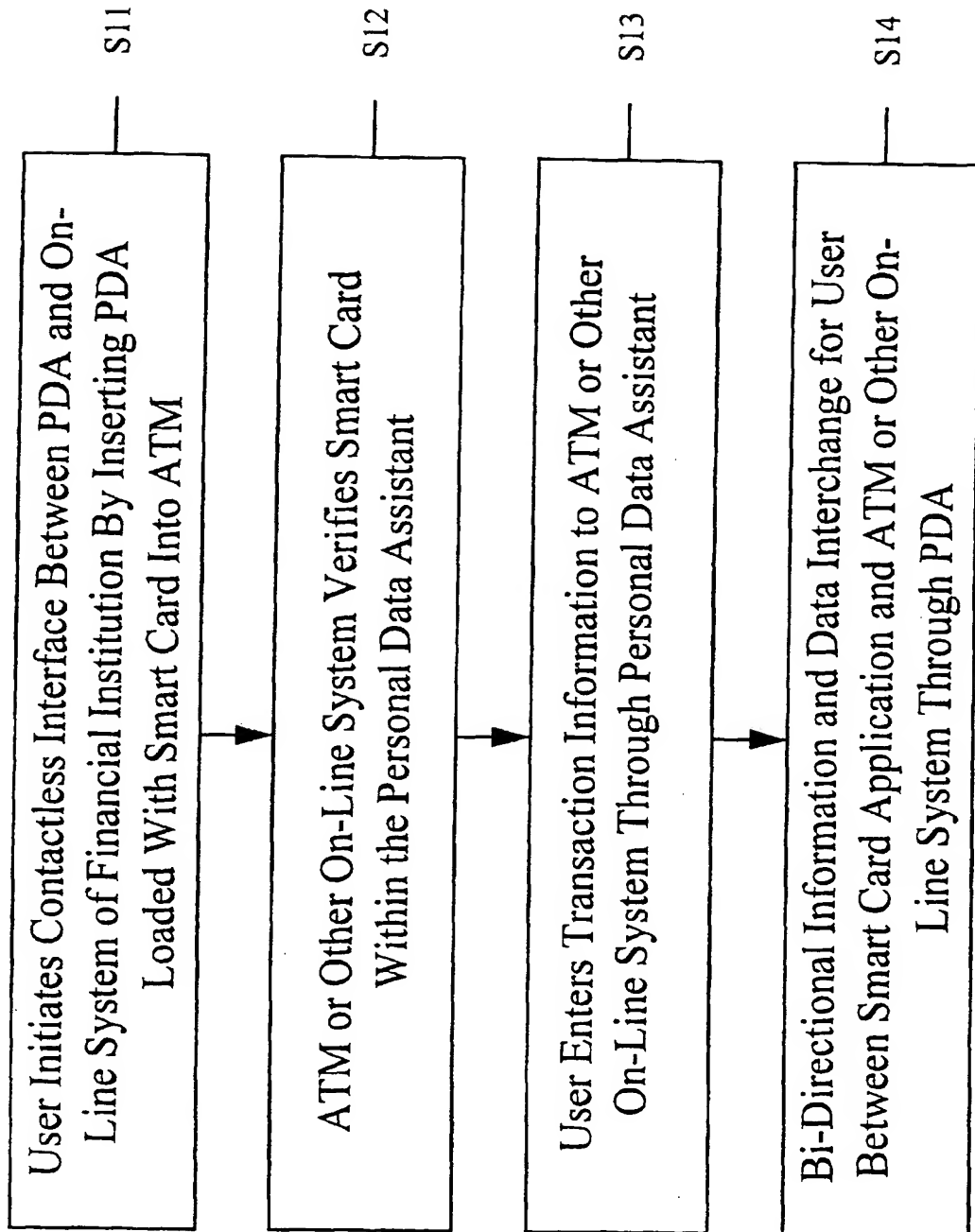
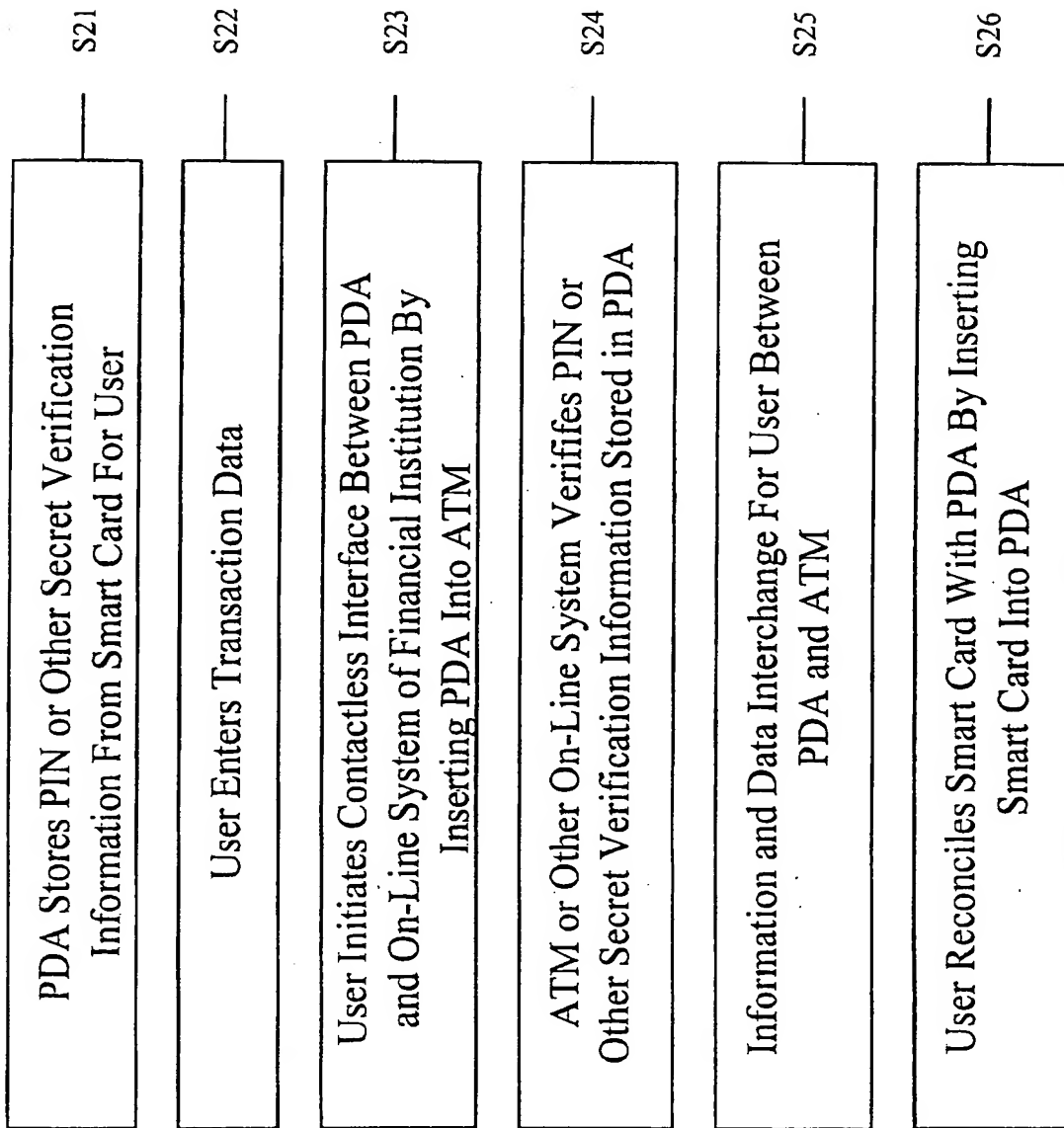


FIG. 6

**FIG. 7**

**FIG. 8**



**FIG. 9**

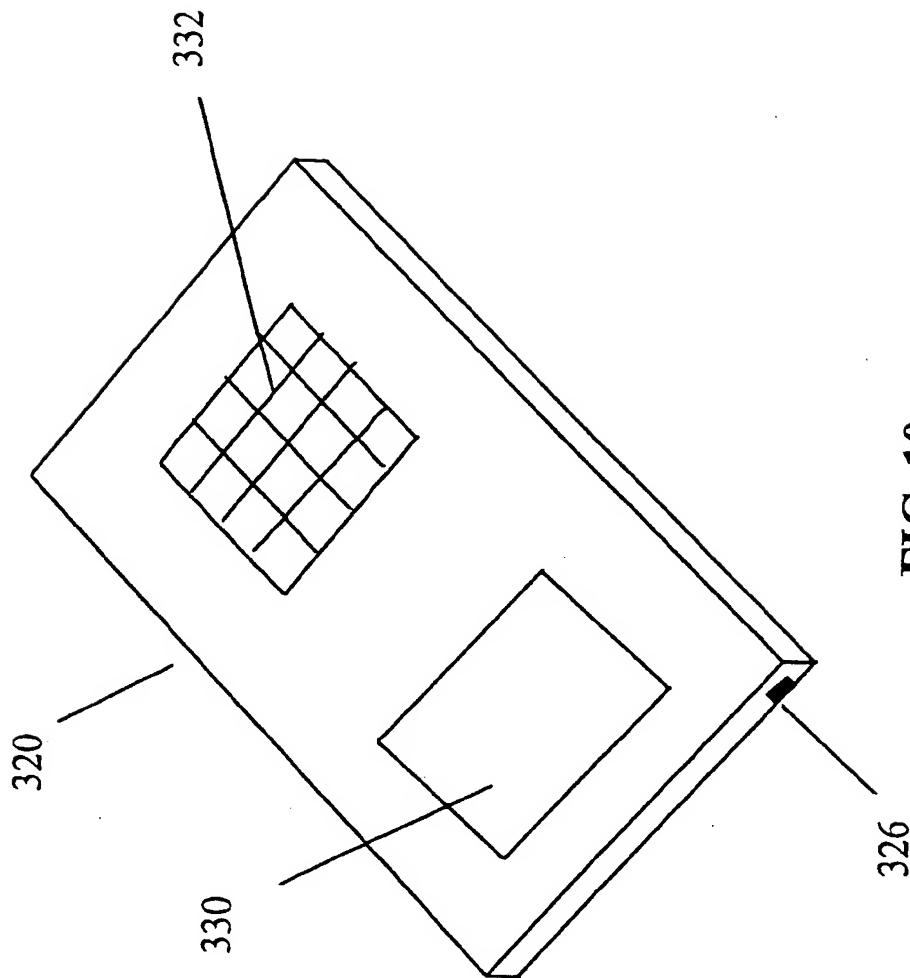


FIG. 10

(19)



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(71) Applicant: **Citicorp Development Center, Inc.**  
**Los Angeles, California 90066 (US)**

(72) Inventor: **Kawan, Joseph C.**  
**Hollywood, CA-90068 (US)**

(30) Priority: **30.01.1998 US 73091 P**

(74) Representative: **Beetz & Partner Patentanwälte**  
**Steinsdorfstrasse 10**  
**80538 München (DE)**

**(54) Method and system of contactless interfacing for smart card banking**

(57) A method and system of smart card banking utilizes a contactless communication interface, such as infrared or a wireless or radio frequency interface, including, for example, a proximity interface. A contactless communication is initiated for a smart card user between a smart card application and the on-line system of a financial institution, such as a bank, the system verifies authorization for the communication, the information is communicated for the user to the on-line system. The contactless communication is initiated, and the informa-

tion is communicated, for example, between a contactless interface transceiver of a personal data assistant, into which the smart card is inserted, and the contactless interface transceiver of an on-line terminal. Alternatively, the contactless communication is initiated, and the information is communicated between a contactless interface transceiver of the smart card and the contactless interface transceiver of the terminal.

**EP 0 933 733 A3**



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 99 10 1544

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Place of search MUNICH		Date of completion of the search 4 September 2003	Examiner Bocage, S
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EPO FORM 1503 03.82 (P.4/C01)



European Patent  
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Application Number  
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<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- &amp; : member of the same patent family, corresponding document</p>			

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